# Vivante Programming:

# ACUITY Operation Mapping and Support

Document Revision 1.14

29 June 2022

Compatible with Vivante ACUITY Toolkit Version 6.9.x

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## Preface

This document provides neural network operation mappings between ACUITY, OVXLIB, and high level neural network (NN) frameworks.

This document contains the following chapters:

- *1, Operation Mappings Between NN Networks and ACUITY*

- *2, ACUITY to OVXLIB Operation Mapping*

For the compatible ACUITY, OVXLIB and Unified Driver versions, see the *Document Revision History* Chapter.

For the supported NN frameworks, see Section *1.1, Supported NN Frameworks*.

# 1 Operation Mappings Between NN Networks and ACUITY

The chapter contains the following sections:

- *1.1, Supported NN Frameworks*
- *1.2, TF to ACUITY Operation Mapping*
- *1.3, TFLite to ACUITY Operation Mapping*
- *1.4, Keras to ACUITY Operation Mapping*
- *1.5, ONNX to ACUITY Operation Mapping*
- *1.6, Caffe to ACUITY Operation Mapping*
- *1.7, Darknet to ACUITY Operation Mapping*

## 1.1 Supported NN Frameworks

ACUITY translates the following NN frameworks into its own formats. Then, ACUITY exports them into OpenVX applications for use with the Vivante Unified Driver.

The supported NN frameworks include:

- TensorFlow (TF) 2.8.0
- TensorFlow Lite (TFLite) generated from TF 2.8.0
- Keras generated from TF 2.8.0
- ONNX 1.11.0
- Caffe
- Darknet

## 1.2  TF to ACUITY Operation Mapping

The following table lists the operation mapping between TensorFlow (TF) and ACUITY.

For the supported TF version, see Section *1.1, Supported NN Frameworks*.

**Note:** In the table, operations in blue are either added or updated in this release.

| TF Operation | ACUITY Operation |
| --- | --- |
| tf.abs | abs |
| tf.add / tf.nn.bias_add | add |
| tf.add_n | addn / add |
| tf.argmin | argmin |
| tf.argmax | argmax |
| tf.batch_to_space_nd | batch2space |
| tf.nn.batch_normalization | batchnormalize / instancenormalize / layernormalize / batchnorm_single |
| tf.nn.fused_batchnorm | batchnormalize |
| tf.cast | cast |
| tf.clip_by_value | clipbyvalue |
| tf.concat | concat |
| tf.nn.conv1d | conv1d |
| tf.nn.conv2d / tf.nn.depthwise_conv2d / tf.nn.conv1d | convolution |
| tf.nn.conv3d | conv3d |
| tf.image.crop_and_resize | cropsandresize |
| tf.nn.conv2d_transposed | deconvolution |
| tf.depth_to_space | depth2space |
| tf.equal | equal |
| tf.exp | exp |
| tf.nn.elu | elu |
| tf.nn.embedding_lookup | embedding_lookup |
| tf.erf | erf |
| tf.maximum | eltwise(MAX) |
| tf.floor | floor |

| TF Operation | ACUITY Operation |
| --- | --- |
| tf.matmul | fullconnect |
| tf.floordiv | floor_div |
| tf.gather_nd | gathernd |
| tf.gather/ tf.nn.embedding_lookup | gather |
| tf.nn.gelu | gelu |
| tf.nn.rnn_cell_GRUCell tf.nn.dynamic_rnn | gru |
| tf.nn.rnn_cell_GRUCell | gru_cell |
| tf.greater | greater |
| tf.greater_equal | greater_equal |
| tf.image.resize_bilinear / tf.image.resize_nearest_neighbor | image_resize |
| tf.contrib.layers.instance_norm / tf.nn.fused_batch_norm | instancenormalize |
| tf.nn.local_response_normalization | localresponsenormalization_tf |
| tf.nn.l2_normalize | l2normalize |
| tf.nn.rnn_cell_LSTMCell / tf.nn_dynamic_rnn | lstm |
| tf.rnn_cell.LSTMCell | lstm_unit |
| tf.less | less |
| tf.less_equal | less_equal |
| tf.logical_or | logical_or |
| tf.logical_add | logical_and |
| tf.logical_xor | logical_xor |
| tf.nn.leaky_relu | leakyrelu |
| tf.multiply | multiply |
| tf.nn.moments | moments |

| TF Operation | ACUITY Operation |
|---|---|
| tf.minimum | minimum |
| tf.matmul / tf.batch_matmul | matmul |
| tf.not_equal | not_equal |
| tf.negative | neg |
| tf.one_hot | one_hot |
| tf.pad | pad |
| tf.transpose | permute |
| tf.nn.avg_pool / tf.nn.max_pool / tf.reduce_mean | pooling |
| tf.nn.max_pool_with_argmax | poolwithargmax |
| tf.nn.max_pool3d | pool3d |
| tf.pow | pow |
| tf.reduce_any | reduceany |
| tf.reduce_max | reducemax |
| tf.reduce_mean | reducemean |
| tf.reduce_sum | reducesum |
| tf.reverse / tf.reverse_sequence | reverse |
| tf.nn.relu | relu |
| tf.nn.relu6 | relun |
| tf.rsqrt | rsqrt |

| TF Operation | ACUITY Operation |
|---|---|
| tf.realdiv | real_div |
| tf.repeat | repeat |
| tf.reshape / tf.expand_dims / tf.squeeze | reshape |
| tf.round | round |
| tf.strided_slice | stridedslice |
| tf.sqrt | sqrt |
| tf.square | square |
| tf.subtract | subtract |
| tf.scatter_nd | scatternd |
| tf.stack | stack |
| tf.nn.sigmoid | sigmoid |
| tf.signal.frame | signalframe |
| tf.slice | slice |
| tf.nn.softmax | softmax |
| tf.space_to_batch_nd | space2batch |
| tf.space_to_depth | space2depth |
| tf.split | split |
| tf.nn.swish | swish |
| tf.tile | tile |
| tf.nn.tanh | tanh |
| tf.unstack | unstack |
| tf.where/tf.select | where |

## 1.3   TFLite to ACUITY Operation Mapping

The following table lists the operation mapping between TensorFlow Lite (TFLite) and ACUITY.

For the supported TFLite version, see Section *1.1, Supported NN Frameworks*.

**Note:** In the table, operations in blue are either added or updated in this release.

| TFLite Operation | ACUITY Operation |
| --- | --- |
| ADD | add |
| ADD_N | addn |
| ARG_MAX | argmax |
| ARG_MIN | argmin |
| AVERAGE_POOL_2D / MAX_POOL_2D | pooling |
| ABS | abs |
| BATCH_TO_SPACE_ND | batch2space |
| BATCH_MATMUL | batch_matmul |
| BROADCASTTO | expand_broadcast |
| CONV_2D / DEPTHWISE_CONV_2D | convolution |
| CONCATENATION | concat |
| CUMSUM | cumsum |
| DEPTH_TO_SPACE | depth2space |
| DEQUANTIZE | dequantize |
| DIV | divide |
| ELU | elu |
| EMBEDDING_LOOKUP | embedding_lookup |
| EXP | exp |
| EQUAL | equal |
| EXPAND_DIMS | expanddims |
| FLOOR_DIV | floor_div |
| FLOOR | floor |
| FULLY_CONNECTED | fullconnet / fullconnet_op |
| GATHER_ND | gathernd |
| GATHER | gather |
| GREATER | greater |

| TFLite Operation | ACUITY Operation |
| --- | --- |
| GREATER_EQUAL | greater_equal |
| HARD_SWISH | hard_swish |
| LOGICAL_OR | logical_or |
| LOCAL_RESPONSE_NORMALIZATION | localresponsenormalization |
| LOGISTIC | sigmoid |
| LSTM | lstmunit |
| L2_NORMALIZATION | l2normalize |
| L2_POOL_2D | l2pooling |
| LESS_EQUAL | less_equal |
| LOGICAL_AND | logical_and |
| LOGICAL_NOT | logical_not |
| LOG_SOFTMAX | log_softmax |
| LESS | less |
| LEAKY_RELU | leakyrelu |
| MAXIMUM | maximum |
| MUL | multiply |
| MEAN | reducemean |
| MIRROR_PAD | pad |
| NON_MAX_SUPPRESSION_V5 | nms |
| NOT_EQUAL | not_equal |
| NEG | neg |
| ONE_HOT | one_hot |
| POW | pow |
| PACK | stack |
| PAD / PADV2 | pad |
| PRELU | prelu |
| RANK | rank |
| REDUCE_ANY | reduceany |
| REDUCE_MIN | reducemin |

| TFLite Operation | ACUITY Operation |
|---|---|
| RSQRT | rsqrt |
| REDUCE_MAX | reducemax |
| RELU | relu |
| RELU1 / RELU_N1_TO_1 / RELU6 | relun |
| RESIZE_BILINEAR/RESIZE_NEAREST_NEIGHBOR | image_resize |
| REVERSE_SEQUENCE | reverse_sequence |
| REVERSE_V2 | reverse_v2 |
| ROUND | round |
| SCATTER_ND | scatternd |
| SEGMENT_SUM | segment_sum |
| SELECT | where |
| SHAPE | shapelayer |
| SIN | sin |
| SQUEEZE / RESHAPE | reshape |
| SPLIT / SPLIT_V | split |
| SOFTMAX | softmax |
| SPARSE_TO_DENSE | sparse_to_dense |

| TFLite Operation | ACUITY Operation |
|---|---|
| SVDF | svdf |
| SQUARE | square |
| SQUARED_DIFFERENCE | squared_difference |
| SUB | subtract |
| SUM | reducesum |
| SLICE | slice |
| SPACE_TO_BATCH_ND | space2batch |
| STRIDED_SLICE | stridedslice |
| SPACE_TO_DEPTH | space2depth |
| TOPK / TOPK_V2 | topk |
| TRANSPOSE_CONV | deconvolution |
| TRANSPOSE | permute |
| TILE | tile |
| TANH | tanh |
| UNIQUE | unique |
| UNPACK | unstack |
| UNIDIRECTIONAL_SEQUEENCE_LSTM | lstm |
| WHERE | where |

## 1.4 Keras to ACUITY Operation Mapping

The following table lists the operation mapping between Keras and ACUITY.

For the supported Keras version, see Section *1.1, Supported NN Frameworks*.

| Keras Operation | ACUITY Operation |
| --- | --- |
| Add | add |
| Activation(relu) | relu |
| Activation(sigmoid) | sigmoid |
| Activation(softmax) | softmax |
| Activation(tanh) | tanh |
| BatchNormalization / BatchNormalizationV1 | batchnormalize |
| Conv1D | conv1d |
| Conv2D | convolution |
| Conv2DTranspose | deconvolution |
| Conv3D | conv3d |
| ConvLSTM2D | conv2d_lstm |
| Cropping2D | slice |
| Concatenate | concat |
| DepthwiseConv2D | depthwise_convolution |
| Dense | fullconnect |
| Embedding | embedding_lookup |
| Flatten / Reshape | reshape |
| GRU | gru |
| LeakyRelu | leakyrelu |

| Keras Operation | ACUITY Operation |
| --- | --- |
| LSTM | lstm |
| Maximum | maximum |
| Minimum | minimum |
| Multiply | multiply |
| MaxPooling2D / AveragePooling2D / GlobalAveragePooling2D / GlobalMaxPooling2D | pooling |
| Permute | permute |
| PRelu | prelu |
| RELU | relu_keras |
| RNN | keras_rnn_lstm |
| SeparableConv2D | depthwise_convolution |
| Subtract | subtract |
| SimpleRNN | lstm_keras |
| Softmax | softmax |
| ThresholdedReLU | relun |
| UpSampling2D | image_resize |
| ZeroPadding2D | pad |

## 1.5 ONNX to ACUITY Operation Mapping

The following table lists the operation mapping between ONNX and ACUITY.

For the supported ONNX version, see Section *1.1, Supported NN Frameworks*.

**Note:** In the table, operations in blue are either added or updated in this release.

| ONNX Operation | ACUITY Operation |
|---|---|
| ArgMin | argmin |
| ArgMax | argmax |
| Add | add |
| Abs | abs |
| And | logical_and |
| BatchNormalization | batchnormalize |
| Clip | clipbyvalue |
| Cast | cast |
| CastLike | cast |
| Ceil | ceil |
| Celu | celu |
| Concat | concat |
| ConvTranspose | deconvolution / deconvolution1d |
| Conv | conv1d / group_conv1d / depthwise_conv1d / convolution / conv2d_op / depthwise_conv2d_op / conv3d |
| Cumsum | cumsum |
| Div | divide |
| Dropout | dropout |
| DepthToSpace | depth2space |
| DequantizeLinear | dequantize |
| Einsum | einsum |
| Equal | equal |
| Erf | erf |
| Exp | exp |
| Elu | elu |
| Expand | expand_broadcast |
| Floor | floor |

| ONNX Operation | ACUITY Operation |
|---|---|
| InstanceNormalization | instancenormalize |
| Gemm | matmul / fullconnect |
| Gather | gather |
| Greater | greater |
| GreaterOrEqual | greater_equal |
| GatherElements | gather_elements |
| GatherND | gathernd |
| GRU | gru |
| HardSigmoid | hard_sigmoid |
| HardSwish | hard_swish |
| Logsoftmax | log_softmax |
| LRN | localresponsenormalization |
| Log | log |
| LeakyRelu | leakyrelu |
| Less | less |
| LessOrEqual | less_equal |
| LSTM | lstm |
| MatMul | matmul / fullconnect |
| Max | eltwise(MAX) |
| MaxPool / AveragePool / GlobalAveragePool / GlobalMaxPool | pooling / pool1d / pool3d |
| MaxRoiPool | roipooling |
| Mean | eltwise(MEAN) |
| MeanVarianceNormalization | instancenormalize |
| Min | eltwise(MIN) |
| Mish | mish |
| Mod | mod |
| Mul | multiply |
| Neg | neg |
| NonZero | nonzero |

| ONNX Operation | ACUITY Operation |
|---|---|
| OneHot | onehot |
| Or | logical_or |
| Prelu | prelu |
| Pad | pad |
| Pow | pow |
| QuantizeLinear | quantize |
| QLinearMatMul | matmul |
| QLinearConv | convolution / conv1d |
| Relu | relu |
| Reshape / Squeeze / Unsqueeze / Flatten | reshape |
| ReduceSum | reducesum |
| ReduceMean | reducemean |
| ReverseSequence | reverse_sequence |
| ReduceMax | reducemax |
| ReduceMin | reducemin |
| ReduceL1 | abs + reducesum |
| ReduceL2 | reducesum + multiply + sqrt |
| ReduceLogSum | reducesum + log |
| ReduceLogSumExp | exp + reducesum + log |
| ReduceProd | reduceprod |
| ReduceSumSquare | multiply + reducesum |
| Reciprocal | variable + divide |
| Resize | image_resize |
| Round | round |

| ONNX Operation | ACUITY Operation |
|---|---|
| ScatterND | scatter_nd_update |
| Shape | shapelayer |
| Sigmoid | sigmoid |
| Sign | sign |
| Sin | sin |
| Size | size |
| Slice | slice / stridedslice |
| Softmax | softmax |
| Softplus | softrelu |
| Softsign | abs + add + divide + variable |
| SpaceToDepth | space2depth |
| Split | split / slice |
| Sqrt | sqrt |
| Squeeze | squeeze |
| Sub | subtract |
| Sum | eltwise(SUM) |
| Tile | tile |
| Transpose | permute |
| TopK | topk |
| Tanh | tanh |
| Unsqueeze | reshape |
| Upsample | image_resize |
| Where | where |
| Xor | not_equal |

## 1.6 Caffe to ACUITY Operation Mapping

The following table lists the operation mapping between Caffe and ACUITY.

For the supported Caffe version, see Section *1.1, Supported NN Frameworks*.

**Note 1:** The current release does not support non-standard Caffe operations.

| Caffe Operation | ACUITY Operation |
|---|---|
| absval | abs |
| axpy | a_times_b_plus_c |
| batchnorm / bn | batchnormalize |
| convolution | convolution |
| concat | concat |
| convolutiondepthwise | convolution |
| dropout | dropout |
| depthwiseconvolution | convolution |
| deconvolution | deconvolution |
| elu | elu |
| eltwise | eltwise |
| flatten | flatten |
| innerproduct | fullconnect |
| lrn | localresponsenormalization |
| l2normalizescale | l2normalizescale |
| leakyrelu | leakyrelu |
| lstm | lstm |
| normalize | l2normalize |
| padchannel | pad |

| Caffe Operation | ACUITY Operation |
|---|---|
| poolwithargmax | poolwithargmax |
| premute | premute |
| prelu | prelu |
| pooling | pooling |
| priorbox | priorbox |
| proposal | proposal |
| reorg | reorg |
| roipooling | roipooling |
| relu | relu |
| reshape | reshape |
| reverse | reverse |
| swish | swish |
| slice | split |
| scale | multiply |
| shufflechannel | shuffle |
| softmax | softmax |
| sigmoid | sigmoid |
| tanh | tanh |

## 1.7   Darknet to ACUITY Operation Mapping

The following table lists the operation mapping between Darknet and ACUITY.

For the supported Darknet version, see Section *1.1, Supported NN Frameworks*.
For more details about Darknet, visit https://pjreddie.com/darknet/.

| Darknet Operation | ACUITY Operation |
|---|---|
| avgpool | pooling |
| batch_normalize | batchnormalize |
| connected | fullconnect |
| convolutional | convolution |
| depthwise_convolutional | convolution |
| leaky | leakyrelu |
| logistic | sigmoid |
| maxpool | pooling |
| mish | mish |
| region | region |

| Darknet Operation | ACUITY Operation |
|---|---|
| reorg | reorg |
| relu | relu |
| route | concat / slice |
| softmax | softmax |
| shortcut | add/slice + add/pad + add |
| scale_channels | multiply |
| swish | swish |
| upsample | upsampling |
| yolo | yolo |

## 2 ACUITY to OVXLIB Operation Mapping

The following table lists the mapping between the ACUITY operations and the OVXLIB operations.

**Note 1:** The OVXLIB operation prefix VSI_NN_OP_ is omitted from the following table.
**Note 2:** In the table, operations in blue are either added or updated in this release.

| ACUITY Operation | OVXLIB Operation |
|---|---|
| abs | ABS |
| add | ADD |
| addn | ADDN |
| argmin | ARGMIN |
| argmax | ARGMAX |
| a_times_b_plus_c | A_TIMES_B_PLUS_C |
| batchnorm_single | BATCHNORM_SINGLE |
| batch2space | BATCH2SPACE |
| batchnormalize | BATCH_NORM |
| cast | DATACONVERT / CAST |
| ceil | CEIL |
| celu | Not available currently |
| conv3d | Not available currently |
| concatshift | CONCATSHIFT |
| crop | CROP |
| concat | CONCAT |
| conv2d_op convolution | CONV2D |
| conv1d | CONV1D |
| conv2d_lstm | CONV2D_LSTM |
| conv3d | CONV3D |
| cos | Not available currently |
| clipbyvalue | CLIP |
| convolutionrelu | CONV_RELU |
| convolutionrelupool | CONV_RELU_POOL |
| depth2space | DEPTH2SPACE |
| downsample | RESIZE |
| divide | DIVIDE |
| dropout | DROPOUT |
| dtype_converter | DATACONVERT |
| dequantize | DATACONVERT |
| depthwise_conv2d_op | CONV2D |

| ACUITY Operation | OVXLIB Operation |
|---|---|
| depthwise_convolution | CONV2D |
| deconvolution | DECONVOLUTION |
| deconvolution1d | DECONVOLUTION1D |
| depthwise_conv1d | DEPTHWISE_CONV1D |
| embedding_lookup | EMBEDDING_LOOKUP |
| einsum | Not available currently |
| erf | ERF |
| expand_broadcast | EXPAND_BROADCAST |
| exp | EXP |
| elu | ELU |
| equal | RELATIONAL_OPS_EQUAL |
| fullconnectrelu | FCL_RELU |
| fullconnect_op | FCL2 |
| floor | FLOOR |
| floor_div | FLOORDIV |
| floor_mod | Not available currently |
| fullconnectaxis | FCL2 |
| fullconnectreluaxis | FCL2 |
| fullconnect | FCL |
| gelu | GELU |
| greater | RELATIONAL_OPS_GREAT |
| greater_equal | RELATIONAL_OPS_GREAT_EQUAL |
| groupnormalize | GROUP_NORM |
| gather | GATHER |
| gather_elements | GATHER_ELEMENTS |
| gathernd | GATHER_ND |
| gru | GRU |
| gru_cell | GRUCELL |
| group_conv1d | CONV1D |
| hard_sigmoid | HARD_SIGMOID |
| hard_swish | HSWISH |

| ACUITY Operation | OVXLIB Operation |
|---|---|
| image_resize | RESIZE |
| instancenormlize | INSTANCE_NORM |
| lstm | LSTM_OVXLIB |
| Localresponsenormalization_tf | LRN2 |
| l2normalizescale | L2NORMALIZESCALE |
| l2pooling | POOL |
| log_softmax | LOG_SOFTMAX |
| log | LOG |
| l2normalize | L2_NORMALIZE |
| layernormalize | LAYER_NORM |
| lstmunit | LSTMUNIT_OVXLIB |
| leakyrelu | LEAKY_RELU |
| less | RELATIONAL_OPS_LESS |
| less_equal | RELATIONAL_OPS_LESS_EQUAL |
| logical_and | LOGICAL_AND |
| logical_not | LOGICAL_NOT |
| logical_or | LOGICAL_OR |
| localresponsenormalization | LRN |
| minimum | MINIMUM |
| max | ELTWISEMAX |
| mod | Not available currently |
| moments | MOMENTS |
| mish | MISH |
| matmul | MATRIXMUL |
| maximum | MAXIMUM |
| multiply | MULTIPLY |
| neg | NEG |
| nms | Not available currently |
| nonzero | Not available currently |
| not_equal | RELATIONAL_OPS_NOT_EQUAL |
| one_hot | ONE_HOT |
| prelu | PRELU |
| pow | POW |
| proposal | PROPOSAL |
| pooling / pool1d | POOL |
| poolwithargmax | POOLWITHARGMAX |
| pool3d | MAX_POOL3D |
| pad | PAD2 |

| ACUITY Operation | OVXLIB Operation |
|---|---|
| permute | PERMUTE |
| quantize | DATACONVERT |
| rank | Not available currently |
| real_div | DIVIDE |
| reducemax | REDUCE_MAX |
| reducemin | REDUCE_MIN |
| reorg | REORG |
| repeat | REPEAT |
| relu | RELU |
| rsqrt | RSQRT |
| relun | RELUN / CLIP |
| relu_keras | RELU_KERAS |
| reduceany | REDUCE |
| reducemean | REDUCE_MEAN |
| reduceprod | Not available currently |
| reducesum | REDUCE_SUM |
| reshape | RESHAPE2 |
| reverse_sequence | REVERSE_SEQUENCE |
| reverse | REVERSE |
| reverse_v2 | Not available currently |
| resizebilinear_image / resizenearest_image | RESIZE |
| roipooling | ROI_POOL |
| round | ROUND |
| sequence_mask | SEQUENCE_MASK |
| sigmoid | SIGMOID |
| scatter_nd_update | SCATTER_ND_UPDATE |
| segment_sum | Not available currently |
| shapelayer | Not available currently |
| sign | Not available currently |
| size | Not available currently |
| sparse_to_dense | Not available currently |
| squared_difference | Not available currently |
| squeeze | RESHAPE2 |
| square | SQUARE |
| subtract | SUBTRACT |
| slice | SLICE |
| space2batch | SPACE2BATCH |
| swish | SWISH |

| ACUITY Operation | OVXLIB Operation |
|---|---|
| shuffle | SHUFFLECHANNEL |
| svdf_ext | SVDF |
| spatialtransformer | SPATIAL_TRANSFORMER |
| signalframe | SIGNAL_FRAME |
| space2depth | SPACE2DEPTH |
| split | SPLIT |
| stridedslice | STRIDED_SLICE |
| stack | STACK |
| stack_concat | TENSORSTACKCONCAT |
| softmax | SOFTMAX |
| softrelu | SOFTRELU |
| sin | SIN |

| ACUITY Operation | OVXLIB Operation |
|---|---|
| sqrt | SQRT |
| scatternd | SCATTER_ND |
| tanh | TANH |
| tile | TILE |
| topk | TOPK |
| upsampling | RESIZE |
| upsample | UPSAMPLE |
| unique | Not available currently |
| unstack | UNSTACK |
| variable | VARIABLE |
| where | WHERE |

# Document Revision History

This section describes changes of each document revision.

| Document Revision | Date | Compatible Software | Change History |
|---|---|---|---|
| 1.14 | 2022-06-29 | • ACUITY 6.9.x and later<br>• Unified Driver 6.4 .11 and later<br>• OVXLIB 1.1.50 and later | • Section *1.1*, *Supported NN Frameworks*:<br>  ▪ Updated the supported TensorFlow version to 2.8.0.<br>  ▪ Added support for TFLite schema from TensorFlow 2.8.0.<br>  ▪ Updated the supported TensorFlow version for Keras model generation from 2.6.0 to 2.8.0.<br>  ▪ Updated the supported ONNX version to 1.11.0.<br>• Section *1.2, TF to ACUITY Operation Mapping*:<br>  Added the TF operation `tf.nn.max_pool3d` and its ACUITY equivalent.<br>• Section 1.3, TFLite to ACUITY Operation Mapping:<br>  Added the following TFLite operations and their ACUITY equivalents: BATCH_MATMUL, BROADCASTTO, and CUMSUM.<br>• Section *1.5, ONNX to ACUITY Operation Mapping*:<br>  Added the following ONNX operations and their ACUITY equivalents: `OneHot`, `Mish`, and `Round`.<br>• Chapter *2, ACUITY to OVXLIB Operation Mapping*:<br>  Added the following ACUITY operations and their OVXLIB equivalents: `gather_elements` and `pool3d`. |
| 1.13 | 2022-03-24 | • ACUITY 6.6.x and later<br>• Unified Driver 6.4 and later<br>• OVXLIB 1.1.4 and later | • Updated the branding and layout to include VeriSilicon.<br>• Section *1.2, TF to ACUITY Operation Mapping*:<br>  Added the TF operation `tf.logical_xor` and its ACUITY equivalent.<br>• Section *1.5, ONNX to ACUITY Operation Mapping*:<br>  Added the following ONNX operations and their ACUITY equivalent: `GatherElements` and `TopK`.<br>• Section *1.6, Caffe to ACUITY Operation Mapping*:<br>  Added the Caffe operation `padchannel` and its ACUITY equivalent.<br>• Chapter *2, ACUITY to OVXLIB Operation Mapping*:<br>  ▪ Updated the ACUITY operation pad with its OVXLIB equivalent changed to PAD2.<br>  ▪ Updated the ACUITY operations `reshape` and `squeeze` with their OVXLIB equivalents changed to RESHAPE2. |
| 1.12 | 2021-12-14 | • ACUITY 6.3.x and later<br>• Unified Driver 6.4 and later<br>• OVXLIB 1.1.37 and later | • Section *1.1, Supported NN Frameworks*:<br>  ▪ Updated the support of TensorFlow 2.3.0 to TensorFlow 2.6.0.<br>  ▪ Updated the supported TensorFlow version for Keras model generation from 2.3.0 to 2.6.0.<br>  ▪ Updated the support of ONNX 1.8.0 to ONNX 1.10.2.<br>• Section *1.5, ONNX to ACUITY Operation Mapping*:<br>  Added the following ONNX operations and their ACUITY equivalents: `CastLike`, `Cumsum`, `HardSwish`, and `MaxRoiPool`.<br>• Chapter *2, ACUITY to OVXLIB Operation Mapping*: |

| Document Revision | Date | Compatible Software | Change History |
|---|---|---|---|
| | | | Added the ACUITY operation `conv3d` and its OVXLIB equivalent. |
| 1.11 | 2021-09-22 | • ACUITY 6.0.0 and later<br>• Unified Driver 6.4 and later<br>• OVXLIB 1.1.34 and later | • *Section 1.2, TF to ACUITY Operation Mapping*:<br>Added the TF operation `tf.nn.gelu` and its ACUITY equivalent.<br>• *Section 1.4, Keras to ACUITY Operation Mapping*:<br>Added the Keras operation ConvLSTM2D and its ACUITY equivalent.<br>• *Section 1.5, ONNX to ACUITY Operation Mapping*:<br>Added the ONNX operation `HardSigmoid` and its ACUITY equivalent.<br>• *Chapter 2, ACUITY to OVXLIB Operation Mapping*:<br>▪ Added the following ACUITY operations and their OVXLIB equivalents: `conv2d_lstm` and `gelu`.<br>▪ Updated the ACUITY operation gru with its OVXLIB equivalent changed to GRU.<br>▪ Updated the ACUITY operation gru_cell with its OVXLIB equivalent changed to GRUCELL.<br>▪ Updated the ACUITY operation lstm with its OVXLIB equivalent changed to LSTM_OVXLIB.<br>▪ Added the OVXLIB equivalent for the ACUITY operation `scatter_nd_update`. |
| 1.10 | 2021-06-28 | • ACUITY 5.24.0 and later<br>• Unified Driver 6.4 and later<br>• OVXLIB 1.1.32 and later | • *Section 1.1, Supported NN Frameworks*:<br>Updated the support of ONNX 1.6.0 to ONNX 1.8.0.<br>• *Section 1.2, TF to ACUITY Operation Mapping*:<br>Added the following TF operations and their ACUITY equivalents: `tf.erf`, `tf.one_hot`, `tf.reduce_any`, `tf.reduce_max`, `tf.repeat`, and `tf.round`.<br>• *Section 1.3, TFLite to ACUITY Operation Mapping*:<br>Added the following TFLite operations and their ACUITY equivalents: ELU, LOGICAL_NOT, NON_MAX_SUPPRESSION_V5, ONE_HOT, PADV2, RANK, REDUCE_ANYREVERSE_SEQUENCE, REVERSE_V2, ROUND, SCATTER_ND, SEGMENT_SUM, SELECT, SHAPE, SIN, SPLIT_V, SPARSE_TO_DENSE, SQUARED_DIFFERENCE, TOPK/TOPK_V2, and UNIQUE.<br>• *Section 1.4, Keras to ACUITY Operation Mapping*:<br>Added the following Keras operations and their ACUITY equivalents: Conv3D, Maximum, Minimum, and Permute.<br>• *Section 1.5, ONNX to ACUITY Operation Mapping*:<br>▪ Added the following ONNX operations and their ACUITY equivalents: Ceil, Celu, Einsum, Erf, GreaterOrEqual, LessOrEqual, Mean, MeanVarianceNormalization, Mod, NonZero, ReduceProd, ScatterND, Shape, Sign, Size, and Unsqueeze.<br>▪ Updated the ONNX operation Conv with an ACUITY equivalent conv3d added.<br>▪ Updated the ONNX operation MaxPool/AveragePool/GlobalAveragePool/GlobalMaxPool with an ACUITY equivalent pool1d added. |

| Document Revision | Date | Compatible Software | Change History |
|---|---|---|---|
| | | | • Chapter *2, ACUITY to OVXLIB Operation Mapping*:<br> ▪ Added the following ACUITY operations and their OVXLIB equivalents: `ceil`, `erf`, `groupnormalize`, `logical_not`, `one_hot`, `pool1d`, `repeat`, `reduceany`, `reverse_sequence`, `round`, `sequence_mask`, and `topk`.<br> ▪ Specified the ACUITY operations that are not mapped to OVXLIB.<br>• Refined the document structure and content. |
| 1.03 | 2020-12-25 | • ACUITY 5.18.0 and later<br>• Unified driver 6.4.5 and later<br>• OVXLIB 1.1.29 and later | • Section 2, Deep Learning Framework-ACUITY Operation Mapping: Updated the compatible version of TensorFlow to 2.3.0.<br>• Section 2.3, TFLite to ACUITY Mapping: Added the TFLite operation `DEPTH_TO_SPACE` and its ACUITY equivalent.<br>• Section 2.4, ONNX to ACUITY Mapping: Updated the ONNX operation `ConvTranspose` with an ACUITY equivalent `deconvolution1d` added.<br>• Section 3, ACUITY to OVXLIB Mapping: Added the ACUITY operation `deconvolution1d` and its OVXLIB equivalent. |
| 1.02 | 2020-09-23 | • ACUITY 5.16.0 and later<br>• Unified driver 6.4.4 and later<br>• OVXLIB 1.1.27 and later | • Section 2: Updated the version of TensorFlow API from 1.13 to 2.0.0.<br>• Section 2.2: Added TensorFlow operation: `tf.cast`.<br>• Section 2.3: Added TFLite operations: ARGMAX, ARGMIN, SUM, and MIRROR_PAD.<br>• Section 2.4:<br> ▪ Added ONNX operations: DequantizeLinear, Expand, `QuantizeLinear`, QLinearMatMul, QLinearConv, Reciprocal, and `Resize`.<br> ▪ Updated ONNX operations: `Slice` and `Split`.<br>• Section 2.6:<br> ▪ Updated the version of TensorFlow from 1.13.x to 2.0.0.<br> ▪ Removed Keras operation: Dropout.<br>• Section 3:<br> ▪ Added ACUITY operations: `expand_broadcast` and `scatternd`.<br> ▪ Updated ACUITY operation: `cast`. |
| 1.01 | 2020-07-24 | • ACUITY 5.15.0 and later<br>• Unified driver 6.4.3.1 and later<br>• OVXLIB 1.1.25 and later | • Section 2.2: Added TensorFlow operation: `tf.nn.conv1`.<br>• Section 2.4: Added ONNX operations: GRU, LSTM, Min, MaxPool/AveragePool, ReduceL1, ReduceL2, ReduceLogSum, ReduceLogSumExp, ReduceSumSquare, Softsign, Softplus, Sin, and Xor.<br>• Section 2.5:<br> ▪ Added Darknet operation: `mish`.<br> ▪ Updated Darknet operations: `logistic`, `route`, and `shortcut`.<br>• Section 2.6:<br> ▪ Removed Keras operation: SimpleRNN.<br> ▪ Updated Keras operation: LSTM.<br>• Section 3: Added ACUITY operation: `sin`. |

| Document Revision | Date | Compatible Software | Change History |
|---|---|---|---|
| 1.00 | 2020-07-09 | • ACUITY 5.14.0 and later<br>• Unified driver 6.4.3 and later<br>• OVXLIB 1.1.24 and later | • Initial release<br>• Adapted from Vivante.AppNote.VIP.Neural.Nework.Layer.and.Operation.Support v1.1.7<br>• Updated format of all tables.<br>• Deleted Section 4. |